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## Newsletter of the Water Research Commission

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## The Brain Behind Membrane Technology

Lingam Pillay, Associate Professor in the Department of Chemical Engineering, Durban Institute of Technology, has generally chosen the less trodden path. Emerging as the top student of Isipingo High School in his matric year, and the recipient of the Dux Award, it was a foregone conclusion that he would enter the fields of medicine or law, then the "staple" prestige career choices in the Indian community. However, encouraged by his dad (a school principal) to break into new fields, he eventually chose a career in chemical engineering."

This innovative scientist completed his BSc(Eng) in Chemical Engineering at the University of Natal, and immediately continued to a MSc (Eng) and a PhD, emerging as the first black PhD graduate in Chemical Engineering. "My dad strongly supported and encouraged me to reach the highest possible qualification in my field before entering the wide world - an opportunity that did not exist in his generation". It was during his PhD that Lingam met another very influential person in his life: Prof Chris Buckley of the Pollution Research Group (PRG) at the University of KwaZulu-Natal. It was upon Chris's suggestion of joining the PRG that Lingam entered the fascinating world of water research. "Chris was a great motivator, and got me involved in various interesting water projects, conferences, visits, etc during my PhD - activities that eventually convinced me that my future career and interest should be in water research. He must accept most of the responsibility for my current involvement in the water sector."

Upon completion of his PhD, Lingam joined the PRG as a Senior Research Fellow. In 1995 a colleague informed him that the Department of Chemical Engineering at M L Sultan Technikon was interested in starting a research programme. "My career in the PRG was developing extremely well. On the one hand, I could continue in a research group that was well established, internationally recognized, and which had excellent partnerships with industry and other research groups. On the other hand, I could move to a historically black technikon which did not have a research culture, had no research resources in my field and was relatively unknown. The choice was obvious - I started at the ML Sultan Technikon in April 1995. I did not see this move as leaving the PRG, but a means of extending water research activities into a new environment".

In 1992, Lingam did a short stint as a post-doc at the UNESCO Centre for Membrane Science and Technology, University of New South Wales, Sydney, Australia. While he was there he met the other person who was to have a major influence on his career - Prof Ed Jacobs, Institute of Polymer Science, University of Stellenbosch.

In 1996, Professor Ed Jacobs initiated a collaborative project on capillary ultrafiltration for drinking water production. This was a major watershed for both Lingam and the Department of Chemical Engineering. Like most researchers, Lingam has attended many conferences, both as a delegate as well as a presenter. He has to his credit, various books, patents, publications in peer-reviewed journals, conference proceedings and technical reports, many of these being WRC-related.

Over the past 10 years, Lingam was exposed to a range of educational models, systems and cultures, both nationally and internationally. "My stint as a visiting lecturer at the Fachhochschule Magdeburg, near Berlin, was notable."

As a senior staff member in the Department of Chemical Engineering, Lingam is actively involved in all aspects of the departmental activities: strategic planning, management, developing partnerships with industry and other institutions and improving the curriculum. "Our ultimate vision is to develop a department that is nationally and internationally recognized for excellence in teaching, applied research, and technology development, and that is recognized as a significant contributor to industry, the national economy and our broader community." However, his primary responsibility has been to kickstart and develop a sustainable research culture. The success of his efforts to date may be judged from the following :

**Formation of the Water Technology Group (WTG).** In 1996 Lingam was largely instrumental in the formation of the WTG group, which focuses on the application of membrane technology in water treatment. The WTG has grown to be recognized as a national centre of expertise in membrane technology development, as well as in human resource development in membrane technologies.

**Model for inter-institutional collaboration.** This model, developed by Lingam and Prof Ed Jacobs, focuses on the development of South African water treatment technologies. The model combines and exploits the expertise and skills of technikon and university researchers, and defines a distinct niche for technikon expertise. The success of the model has caught the attention of various national and international researchers and funding institutions. The National Research Foundation (NRF) recently featured this inter-institutional, multi-disciplinary collaboration model in the publication *Research Files: From Africa for Africa* (August 2002). The model has also been selected as a case study on research utilization by the Centre of Interdisciplinary Studies, University of Stellenbosch.

**Collaboration with industry and other institutions.** Lingam and his team have been successful in developing collaborative projects with industry and other tertiary institutions. Apart from increasing the profile of the Department, these efforts have also increased the profile of the institution in these communities.

**Mentorship.** Lingam has mentored many students. Of importance are his efforts to attract students from historically disadvantaged backgrounds. The number of black researchers has grown tremendously. One notable example is that of Vincent Ndinisa, who joined the group as an in-service trainee in 1997. He is now a lecturer in the department and for the past two years has been studying towards a Masters degree at the UNESCO Centre for Membrane Science and Technology, University of New South Wales, Australia. The Masters was recently upgraded to a PhD. Mr Ndinisa will probably be the first "home grown" research leader in the department. Two of Prof Pillay's ex-students are currently employed by international membrane companies.

**Financial sustainability.** Lingam's group has been successful in leveraging funding from industry and funding organizations, primarily via contract research projects. This funding is used for student bursaries, capital equipment and operating expenses, thus reducing the burden on the Institute's research funds. During the period 1996-2001 75% of the research budget was sourced from external funding. During 2002-2003, over 95% of the research budget was obtained outside the institution.



**Technological outputs.** Lingam's team has been focusing on the development of appropriate technologies for developing economies, in close partnership with Prof Ed Jacobs. The major projects include:

**Small-scale capillary UF system for potable water production in rural areas.**

**Ultrafiltration systems for industrial effluent treatment.**

**Immersed microfilter.**

**Active precoat microfilter.**

This progressive researcher credits the WRC for "driving water research in South Africa. The WRC's foresight has also carved a niche in the field of membrane technology, making it a forerunner and a global player. I see membrane technology as the future for water and effluent treatment in Africa."

Dr Gerhard Offringa, Research Manager at the WRC says, "Prof Pillay, together with his group at DIT, has succeeded admirably in transforming theoretical membrane science into a practical and workable technology which can be applied in water and effluent treatment to the benefit of both industry and the general population."

Prof Pillay, the WRC thanks you for your contribution to water research thus far and we predict that your drive will still yield greater innovation in the years ahead



## Lunch with Honourable Minister Sonjica

On 31 May 2004, the CEO of the WRC presented a talk to a joint sitting of the Parliamentary Portfolio Committee on Water Affairs & Forestry as well as the Select Committee on Land & Environmental Affairs.

The CEO, Dr Rivka Kfir, and the WRC Board Chairperson, Prof H Kasan, enjoyed lunch with the new Minister of Water Affairs and Forestry, the Honourable Buyelwa Sonjica. Apart from a cordial social atmosphere, discussions on matters, where the WRC had a definite role to play, were also discussed. Both Prof Kasan and Dr Kfir pledged their support to Minister Sonjica and her goals and vision in her new position.

## Training Course

The International Ocean Institute of Southern Africa, based at the University of the Western Cape, jointly with the UNESCO-IHE Institute for Water and the UNEP/GPA Coordination Office in the Netherlands will be presenting a training course on "Improving Municipal Wastewater Management in Coastal Cities" from 2-6 August 2004 at the UWC Campus.

This 5-day training course is offered as a supplement to existing capacity-building initiatives in the water and sanitation fields.

The course is completely free as all materials and supplementation for the week will be provided. Only costs to the participant would be their travelling to the venue and, if they are coming from outside of Cape Town, their accommodation as well.

For further information visit [www.gpa.unep.org/training](http://www.gpa.unep.org/training).

## Farewell Lindani

Lindani Gumede joined the WRC as a web developer in December 2000. When Edward Sebola, an IT officer at the WRC, resigned in December 2002, Lindani assumed his functions in January 2003. He has decided to run his own consultancy. Lindani, the WRC thanks you for your contributions and wishes you well in your future endeavours.



## A winner for WIN!

WIN (Water Information Network) is an embryonic network of organizations in South Africa focusing on improving knowledge management and sharing in the water and sanitation sector, targeting local government and other decision-makers. WIN is led by a Steering Committee comprising the Water Research Commission (WRC), which also hosts WIN on its website; South African local Government Association; Department of Provincial and Local Government; Department of Water Affairs and Forestry; Masibambane; Mvula Trust; National Community Water Supply and Sanitation Training Institute; South African Association of Water Utilities; National Inquiry Services Centre; International Water Management Institute; Department for International Development and the IRC International Water and Sanitation Centre (Netherlands).

Ms Ndala Duma was appointed as WIN co-ordinator. This young lady with a charming personality began her career as an educator: mainstream, adult as well as community-based education, a position which she held for eight years. She then worked as a Provincial Coordinator for the IEC's democracy development programme in KwaZulu-Natal, as part of the preparation for the 2004 elections. Presently, she has the mammoth task of coordinating the activities of WIN and to oversee the implementation plan of the network. "I see my position at the WRC as a crucial one. The success of WIN will be a positive reflection on the WRC, and it will enhance its work, especially in informing researchers and stakeholders, including communities, about the wealth of knowledge that exists and is being generated at the WRC."

The great impetus behind Ndala's drive and ambition lies in having been raised by her mother, whom she refers to as a "strong woman". She's also been highly motivated and inspired throughout her career, by people who are passionate about the work they do. Ndala's decision to become an educator was based on the tenet of making a difference in people's lives, a tenet that still forms the basis of her current position.

Dr Innocent Msibi, Director: Water-Centred Knowledge at the WRC says, "We were looking for someone with incredible personality and drive – Ndala has both."

When she is not out on a quest for information, she enjoys reading, traveling and good movies. "I look forward to a fruitful career at the WRC and look forward to working with a professional bunch of people. I hope to get accustomed to the dry air in Pretoria and to rid myself of the nostalgia of the KZN sea breeze." Ndala, we at the WRC welcome you to the WRC and we look forward to working with you.





## What's New

### Report No 1033/1/04 (Contractor: Durban Institute of Technology) Caustic management and reuse in the beverage bottling industry

This project evaluated three membrane systems for the recovery of caustic at industries where the caustic is used for bottle washing and cleaning purposes: The woven fibre microfilter (WFMF); capillary ultrafilter (CUF) and a tubular nanofilter (TNF) were evaluated. The evaluations were based on performance criteria: separation efficiency, permeate fluxes, resistance to caustic and cleanability of the membranes. The two systems that could be considered for caustic cleanup are CUF and TNF since both yielded promising removal of suspended contaminants. In terms of capital and operating costs, the CUF systems proved to be economically viable. In the light of the separation efficiency of the TNF system being marginally superior to the CUF system, the CUF system appears to be a better alternative for caustic clean-up.

### Report No 1244/1/04 (Contractor: University of Cape Town) A novel one-step ambient temperature ferrite process for the removal of metals from acid mine drainage (AMD)

This project investigated the removal of dissolved metals from AMD. This involved transforming the high concentrations of ferrous iron found in AMD into magnetite. This study attempted to form magnetite at ambient temperatures. A novel steady state, continuous flow, ambient temperature ferrite process was created which was unique in five aspects: Ferrous iron present in AMD is oxidized by the oxygen in air, at ambient temperature, to the ferrite magnetite; the reactor configuration is such that the bulk AMD flow is immediately separated from the metals removal process, thus lowering the hydraulic retention time of the bulk volume; apart from the initial amount of magnetite seed, air, and a pH elevating agent, no other chemical additives are required; the process chemistry of ambient temperature ferrite formation has been systematically defined; the problem of calcium interference arising from the use of lime as a pH elevating agent has been solved.

### Report No 1383/1/04 (Contractor: Palmer Development Group) Economic regulation of water services in South Africa

Economic regulation is defined as the protection of the public interest through the promotion of effective, financially viable and sustainable water services providers. The three questions that formed the basis of the project were: How will a "regulator" determine if the average price level is appropriate? How will a "regulator" determine what level of investment is appropriate?; How does the institution/governance model affect the above two questions? The scope of the study extended to both water and sanitation, to both bulk and retail water and sanitation. The study produced the following outputs: a Phase 1 draft report, four working papers, a draft guideline and a final report.

### Report No 1384/1/04 (Contractor: Sigodi, Marah, Martin) Effective cost recovery in a changing institutional and policy environment: Municipal demarcation, the "free basic water" policy, and financially sustainable service delivery

The overall objective of this project was to make an assessment of the level of cost recovery as far as local government is concerned, and to identify which measures are the most effective in increasing the rate of collection. The report highlights the implications of the findings for municipal officials and national policy makers seeking to overcome obstacles to successful cost recovery. An assessment is also made of the impact of the free basic water policy, and the issue of unaccounted-for-water. The project also revealed that the reconfiguration of municipalities, coupled with the implementation of the free basic water policy, has had a marked influence on how recovery of costs can be enhanced. On the one hand, initiatives geared towards the lower end of the market are overshadowed by the impact of the free basic water policy. On the other hand, the implementation of punitive sanctions against non-indigent consumers who fail to pay a progressive, volume-related tariff, takes on increasing importance. However, it must be noted that just as punitive sanctions become necessary, they are also expensive to implement.

### Report No 1280/1/04 (Contractor: Peninsula Technikon) Sanitation demand and delivery in informal settlements- Planning and implementation support

This project focused on the development of a planning and implementation framework for basic sanitation services in informal settlements in the City of Cape Town. An inclusive approach to the research involved key stakeholders (officials, NGOs and community participants) in identifying the elements that need to be addressed in order to guide effective planning

and action. The proposed framework also has the potential of wider application in the development of service delivery protocols through an action research methodology. This report is the culmination of the first phase of developing this framework.

### Report Nos. 1177/1/04 & 1177/2/04 (Contractor: Ninham Shand) Quantifying the influence of air on the capacity of large diameter water pipelines and developing provisional guidelines for effective de-aeration.

#### Vol 1: Quantifying the influence of air on the capacity of large diameter water pipelines

#### Vol 2: Provisional guidelines for the effective de-aeration of large diameter water pipelines

The objective of this study was to conduct experimental and field work to establish the influence of air in pipelines and strategies to effectively manage and de-aerate pipelines. Due to the erratic flow path of air bubbles that are transported along a pipeline it was necessary to derive a relationship for the required discontinuity that should be created to capture the air for mechanical removal from the pipeline. Experimental work and numerical analyses were used to compare the effectiveness of a specific size of discontinuity to capture the air that is transported along the pipe. These experimental results reflected that to effectively de-aerate a pipeline the size of the discontinuity should be at least 35% of the pipe diameter. The study has confirmed that flow velocity, air bubble size and the down slope of the pipeline are the main contributing factors, which determine whether the air can be removed hydraulically. Based on the study and results, provisional guidelines were prepared, describing the influence of air on the capacity of large diameter pipes and providing details to ensure effective de-aeration. Furthermore, an air valve sizing and positioning (ASAP) procedure has been developed and incorporated into utility software for the determination of air valve sizes and locations.

### Report No TT 205/03 (Contractor: CSIR) Elementary handbook of water disinfection

This handbook provides readers with an introduction to the processes of water disinfection. Emphasis is placed on chlorination and chloramination. Discussions of the processes of chlorine dioxide treatment, ozonation, mixed oxidants and ultraviolet irradiation are included. The handbook is intended for non-specialists in chemistry and microbiology and affords the reader a basic understanding of the processes involved. Suggested sources for further reading on the various processes have been included. This handbook is an abridged and simplified version of the extensive work titled *Guide to the Chemistry, Biochemistry and Microbiology of Chemical Water Disinfection Processes* by F.H.H. Carlsson and P.W. Wade.

### Report No TT 218/03 (Contractor: Parsons & Associates) Surface water- Groundwater interaction in a Southern African Context

This handbook is aimed at providing water resource managers and environmentalists with information regarding surface-groundwater interaction in order to facilitate a better understanding thereof. Three issues contribute to the poor understanding of surface-groundwater interaction: not all subsurface water is groundwater- only that water in the saturated zone is defined as groundwater; not all baseflow is derived from groundwater- baseflow also includes the contribution of interflow discharged into streams and rivers from the unsaturated zone; inconsistent and misuse of terminology among the hydrological fraternity, and elsewhere. The correct use of hydrological terminology is considered to be vital for developing a better understanding of surface-groundwater interaction.

### Report No TT 222/04 Feasibility of water fluoridation for South Africa

Following widespread debate, a task team of five persons were given the mandate to investigate the fears, the claims, the counter-claims and unknowns about the topic of water fluoridation. Each of the team members was a specialist in a particular area of the topic. The issues can be categorized as follows: Medical and dental issues; environmental issues, technical issues, economic issues and social and legal issues. In a diverse country such as South Africa, the one size fits all scenario cannot apply. South African legislation calls for each water provider to individually register for water fluoridation, reflecting the unique requirements and constraints of each. This report will assist water suppliers to identify their own constraints and problems, if any.

Reports can be ordered at [orders@wrc.org.za](mailto:orders@wrc.org.za)



## FR Tomlinson Commemorative Lecture

During the 1980s members of the Agricultural Economics Association of South Africa (AEASA) such as Dr Gerhard Backeberg (WRC) and Johan van Rooyen initiated an annual commemorative lecture in the name of the first president of AEASA and doyen of the agricultural economics establishment of South Africa, Prof FR Tomlinson.

Dr Gerhard Backeberg delivered the 17<sup>th</sup> commemorative lecture at the University of Pretoria on 17 June 2004 and received a gold medal for his contribution to the AEASA. His talk "Research Management of Water Economics in Agriculture - An Open Agenda" can be accessed on the WRC website [www.wrc.org.za](http://www.wrc.org.za).



*Dr Gerhard Backeberg flanked by Prof MF (Giel) Viljoen (R) Prof JF (Johan) Kirsten (L)*

## The WRC @ the SASAqS Conference

The SASAqS (South African Society of Aquatic Scientists) held their Annual Conference at the Eskom Convention Centre, Midrand from 5-7 July 2004. The WRC was the sole exhibitor and many reports were ordered. The popular "Guide to Freshwater Invertebrate" series impressed many of the delegates.

Dr Heather MacKay was one of the organizers of this conference. She also delivered a talk titled "A framework for interdisciplinary understanding of rivers".



*SASAqS: Some of the visitors to at the WRC stand*

## Streams of Knowledge

Streams of Knowledge is a global coalition of water and sanitation resources centers that have agreed to work together to reach the millennium development goals (MDG) via the core principles embodied in VISION 21. Resource centres in the field of water and sanitation are well placed to support national and international efforts to accelerate these developments in the sector.

This organization held its management Board meeting at the WRC recently. Dr Rivka Kfir, CEO of the WRC, is also the Chairperson of this organization.



*The members of Streams of Knowledge at the WRC*

## Launch: State of the Environment Report

On Friday 4 June 2004, the City of Johannesburg: Department of Development Planning, Transportation and Environment launched the State of the Environment Report and celebrated World Environment Week.

DR Kevin Pieterse was invited to speak at this gathering of local councilors, learners, mayoral representative, members of provincial and local government and other guests. His topic was "Integrated Urban Water Resource Management: Challenges and Opportunities". His talk was well received and generated thought-provoking questions and possible solutions. On 17 June the WRC was invited to exhibit at a further launch of this report.



*Andrew Sanewe at the busy WRC exhibition*